CLAIMS

1. A process for the preparation of a polymer composite comprising internally distributed deposition matter wherein the process comprises providing a deposit of deposition matter at the surface of a solid state polymer substrate, contacting the surface deposited polymer with a plasticising fluid or a mixture of plasticising fluids under plasticising conditions to plasticise and/or swell the polymer and internally distribute deposition matter, and releasing the plasticising fluid or fluids to obtain polymer composite.

2. A process as claimed in Claim 1 which comprises providing a deposit at the surface of a high surface area polymer substrate, more preferably a powder bed or a high porosity matrix.

3. A process as claimed in any of Claims 1 and 2 wherein a deposit comprises a deposition layer of deposition matter on the internal and external surfaces of the polymer substrate, more preferably any exposed surfaces, including any exposed surface pores; over the entire surface area or only part or parts thereof.

4. A process as claimed in any of Claims 1 to 3 which comprises in a first stage contacting polymer with plasticising fluid or a mixture of plasticising fluids under plasticising conditions to plasticise the polymer, and releasing the fluid in manner to obtain a solid state substrate polymer; in a second stage providing a surface deposit of deposition matter at the surface of the polymer, and in a third stage contacting the surface deposited polymer with a plasticising fluid or a mixture of plasticising fluids under plasticising conditions to plasticise and/or swell the polymer and internally distribute

deposition matter, and releasing the plasticising fluid or fluids to obtain polymer composite.

5. A process as claimed in any of Claims 1 to 4 wherein a deposit is of discrete particles or of dissolved deposition matter and is by solid or fluid phase deposition of deposition matter provided in solid phase by powder coating, dusting, rolling or adhering deposition matter; or of deposition matter provided in fluid phase by immersion, spraying and the like with a solution, dispersion or suspension of deposition matter and drying by freezing, evaporation, heating, blotting etc.

6. A process as claimed in Claim 5 wherein immersion is for a time of the order 1 second up to 48 hours.

7. A process as claimed in any of Claims 5 and 6 wherein drying is for a time up to 48 hours.

8. A process as claimed in any of Claims 1 to 7 wherein deposition matter is provided in particulate or powder form and is of particle size in the range up to 1mm, preferably 50 – 1000 micron.

9. A process as claimed in any of Claims 1 to 8 wherein polymer is in solid phase which is particulate or monolithic or is a highly viscous fluid and may form either a particulate composite or form a monolithic composite on release of plasticising fluid.

10. A process as claimed in any of Claims 1 to 9 wherein plasticising conditions comprise a temperature in the range –200°C to +500°C, preferably –200°C to 200°C.

11. A process as claimed in any of Claims 1 to 10 wherein plasticising conditions comprise a pressure from in excess of 1 bar to 10000 bar, preferably 1 to 1000 bar.

12. A process as claimed in any of Claims 1 to 11 wherein fluid is provided at plasticising conditions prior to contacting with polymer and deposition matter or is brought to plasticising conditions in contact with surface deposited polymer.

13. A process as claimed in any of Claims 1 to 12 wherein the process is carried out for a contact time of surface deposited polymer and plasticising fluid of 1 millisecond up to 5 hours.

14. A process as claimed in any of Claims 1 to 13 wherein the pressurisation period whereby in the case of *in situ* or ex situ pressurisation the fluid is pressurised or is introduced to the surface deposited polymer, is for a period of 1 second to 3 minutes.

15. A process as claimed in any of Claims 1 to 14 wherein the depressurisation period is rapid over a period of from 1 ms to 10 minutes; or is by prolonged gradual release of fluid over a period of in excess of 10 minutes up to 12 hours.

16. A process as claimed in any of Claims 1 to 15 wherein plasticising fluid includes carbon dioxide, di-nitrogen oxide, carbon disulphide, aliphatic C_{2-10} hydrocarbons such as ethane, propane, butane, pentane, hexane, ethylene, and halogenated derivatives thereof such as for example carbon tetrafluoride or chloride and carbon monochloride trifluoride, and fluoroform or chloroform, C_{6-10} aromatics such as benzene, toluene and xylene, C_{1-3} alcohols such as

methanol and ethanol, sulphur halides such as sulphur hexafluoride, ammonia, xenon, krypton, and mixtures thereof.

17. A process as claimed in any of Claims 1 to 16 wherein deposition matter is present in an amount with respect to polymer of $1x10^{-12}$ wt% to 99.9 wt%

18. A process as claimed in Claim 17 wherein deposition matter is present, presented as concentration of deposition matter on polymer, in low volumes in the range $1x10^{1}$ to $1x10^{3}$ ng/mg.

18. A process as claimed in any of Claims 1 to 17 wherein deposition material includes (pharmaceutical) drugs and veterinary products; agrochemicals as pest and plant growth control agents; human and animal health products; human and animal growth promoting, structural, or cosmetic products including products intended for growth or repair or modelling of the skeleton, organs, dental structure and the like; absorbent biodeposition materials for poisons, toxins and the like.

19. A process as claimed in any of Claims 1 to 18 wherein deposition matter alternatively or additionally comprises function enhancing components, including naturally occurring or synthetic or otherwise modified growth promoters, biocompatibilisers, vitamins, proteins, glycoproteins, enzymes, nucleic acid, carbohydrates, minerals, nutrients, steroids, ceramics and the like and functioning matter such as spores, viruses, mammalian, plant and bacterial cells and the like.

20. Process as claimed in any of Claims 1 to 19 wherein polymer is selected from: polyesters including poly(lactic acid), poly(glycolic acid), copolymers of lactic and glycolic acid, copolymers of lactic and glycolic acid

with poly(ethylene glycol), poly(e- caprolactone), poly(3-hydroxybutyrate), poly(p-dioxanone), poly(propylene fumarate); poly (ortho esters); polyanhydrides; Poly(amino acids); polyacetals; polyketals; polyorthoesters; Polyphosphazenes; azo polymers; synthetic Non-biodegradable Polymers selected from: Vinyl polymers including polyethylene, poly(ethylene-co-vinyl acetate), polypropylene, poly(vinyl chloride), poly(vinyl acetate), poly(vinyl alcohol) and copolymers of vinyl alcohol and vinyl acetate, poly(acrylic acid) poly(methacrylic acid), polyacrylamides, polymethacrylamides, polyacrylates, Poly(ethylene glycol), Poly(dimethyl siloxane), Polyurethanes, Polycarbonates, Polystyrene and derivatives; and Natural Polymers selected from carbohydrates, polypeptides and proteins.

21. A polymer composite obtained with the process of the invention as claimed in any of Claims 1 to 20.

22. A polymer composite comprising a porous or non porous polymer throughout which particulate deposition matter as hereinbefore defined is distributed with desired uniformity, preferably with high uniformity in excess of 80% for example in excess of 98%.

23. A polymer composite as claimed in Claim 22 which comprises low levels of deposition matter, presented as concentration of deposition matter on polymer, in low volumes in the range $1x10^1$ to $1x10^3$ ng/mg at excellent levels of uniformity and batch reproducibility, and/or of very low particle size of the order of 10 microns, 1 micron or 0.1 microns.

24. A polymer composite as claimed in any of Claims 22 and 23 which is in granular or monolith form.

25. A scaffold comprising a polymer composite having internally distributed deposition matter as claimed in any of Claims 22 to 24 suitably sized and shaped for a desired application.

26. A process for the preparation of a polymer composite as claimed in any of Claims 1 to 21, polymer composite as claimed in any of Claims 22 to 25, or a scaffold thereof for use as a support or scaffold for drug delivery, for use in bioremediation, as a biocatalyst or biobarrier for human or animal or plant matter, for use as a structural component, for example comprising the polymer and optional additional synthetic or natural metal, plastic, carbon or glass fibre mesh, scrim, rod or like reinforcing for medical or surgical insertion, for insertion as a solid monolith into bone or tissue, as fillers or cements for wet insertion into bone or teeth or as solid aggregates or monoliths for orthopaedic implants such as pins, or dental implants such as crowns etc.

27. A process for preparing a polymer composite, a polymer composite, a scaffold, or the use thereof substantially as described in the description or illustrated in the Examples.